



Impacts of a Cascadia Subduction Zone Earthquake

Presentation to the Communications Academy

Robert Ezelle, Emergency Management Director

14 April 2018

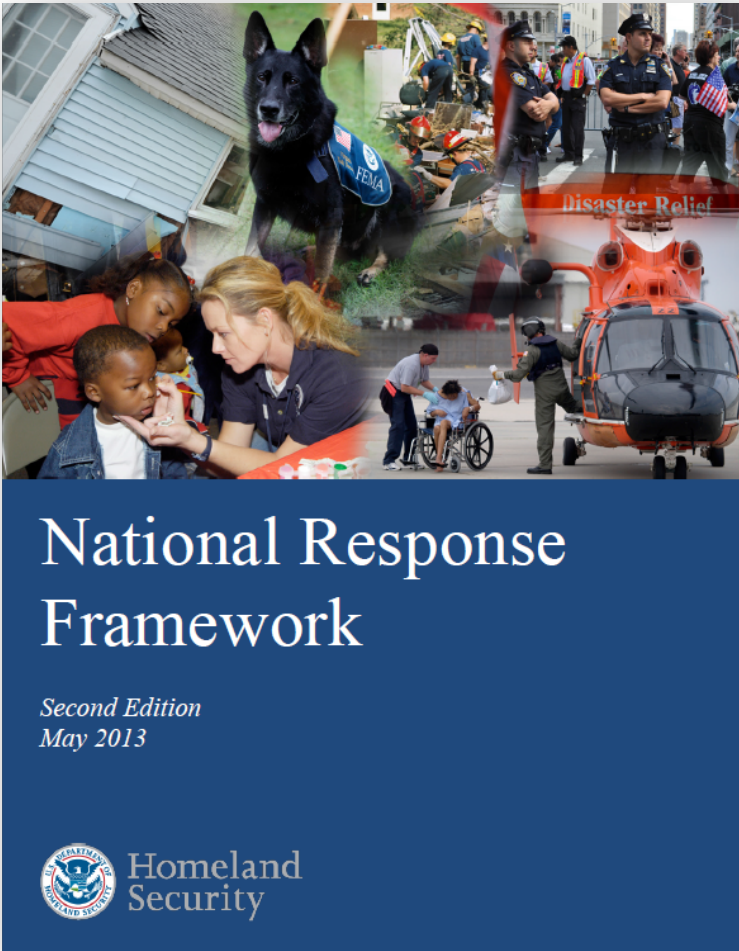


EMD Mission

EMD leads and coordinates mitigation, preparedness, response and recovery in Washington State to minimize the impact of disasters and emergencies on the people, property, environment and economy.



National Response Framework (NRF)



- Guidance for all-hazards response
- Partnership between all levels of government:
 - Local government responds first
 - State government assists as needed
 - Federal government assistance as the last resort



NIMS/ICS Across All Levels of Government

Off-scene Coordination

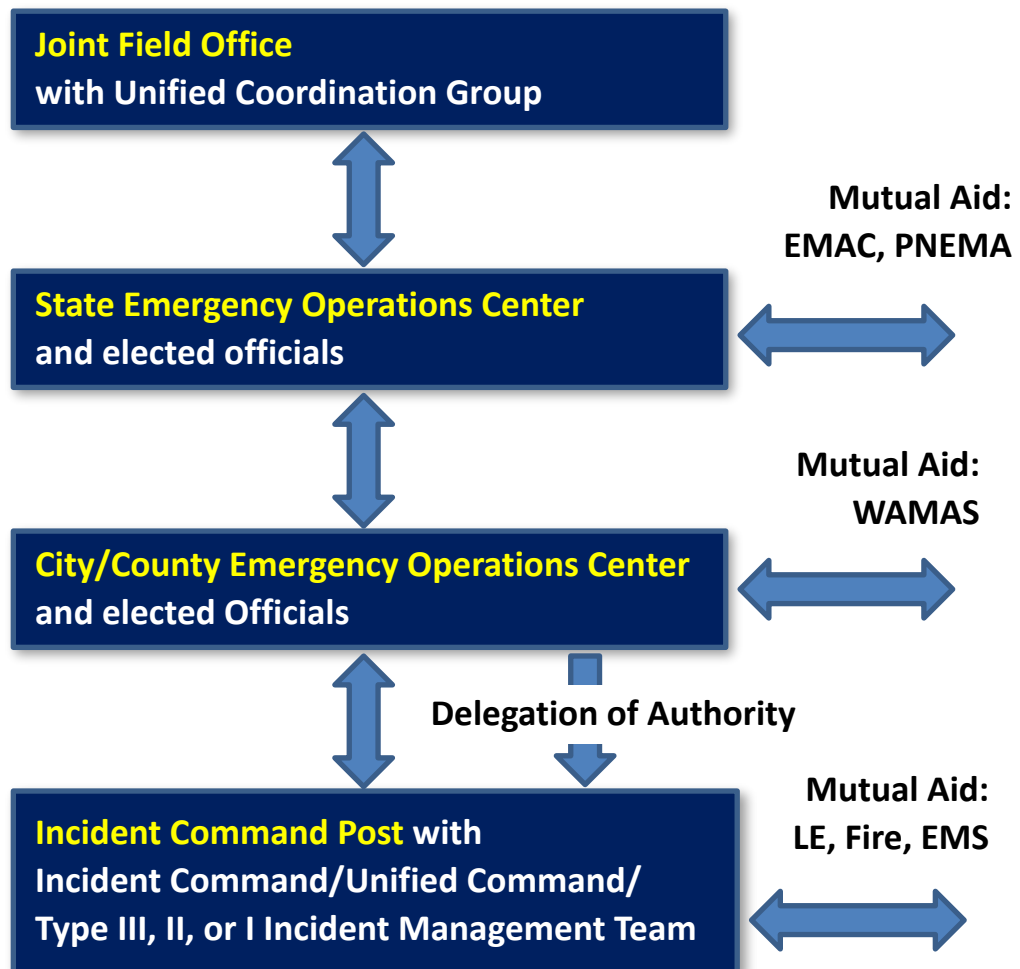


On-scene Command



Requests and Information

Resources





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Seasonal Hazards



Copyright John Chao





Geologic Hazards





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Other Hazards





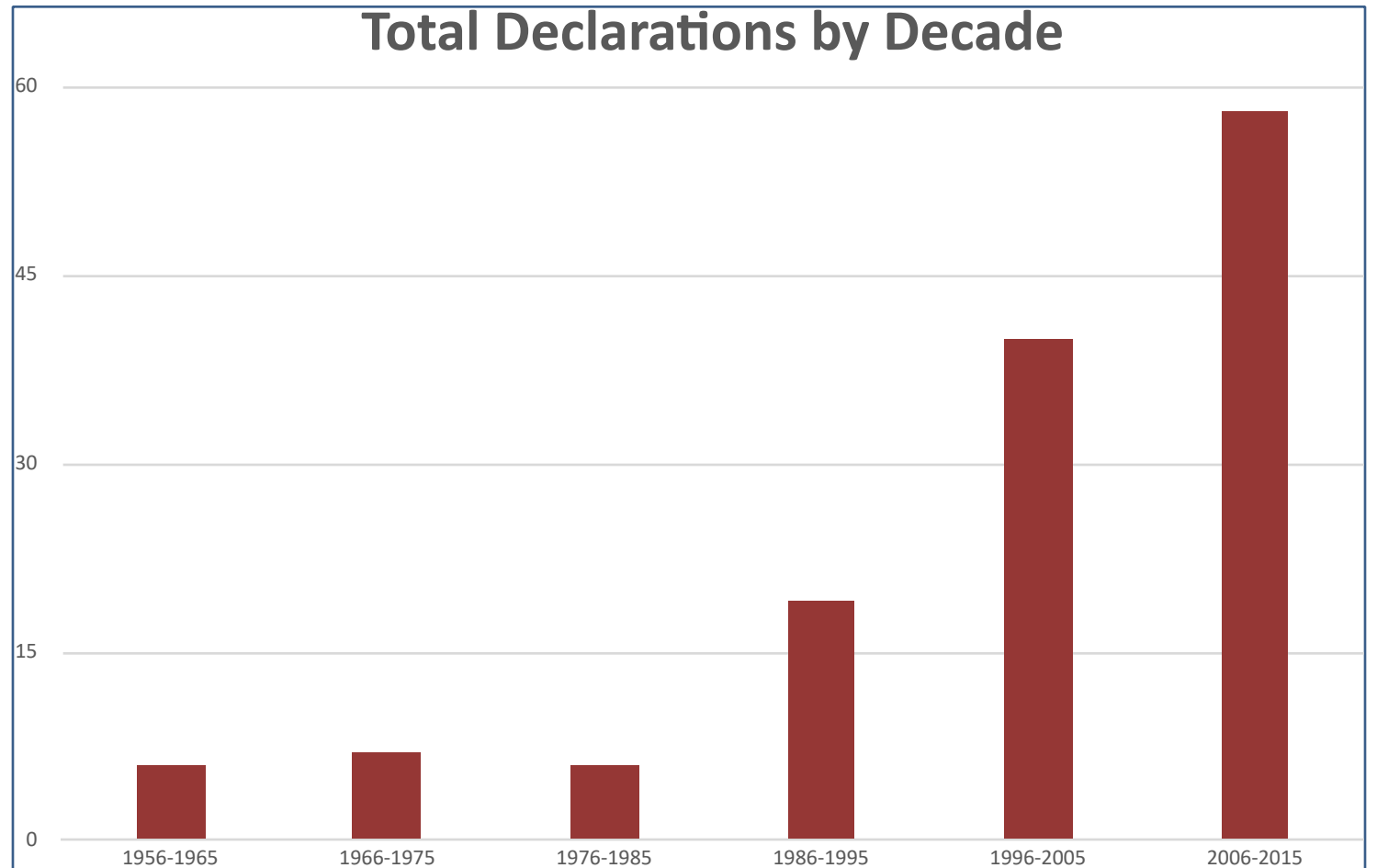
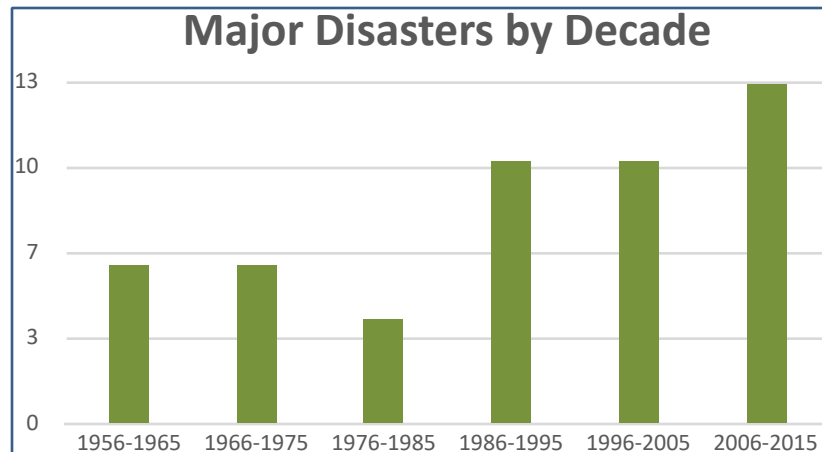
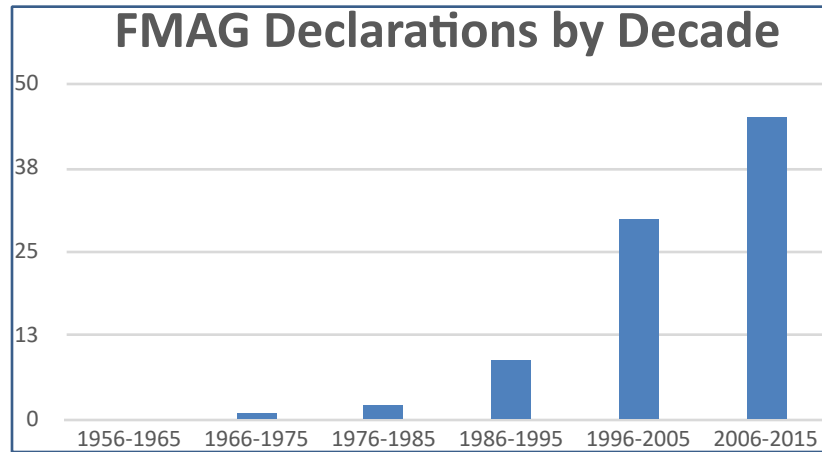
Washington's Disasters Over Time

Since 1956 – 152 Federal Declarations

- 53 Major Disasters
- 7 Emergency Declarations
- 92 Federal Fire Suppression/Management Declarations



Disaster Growth

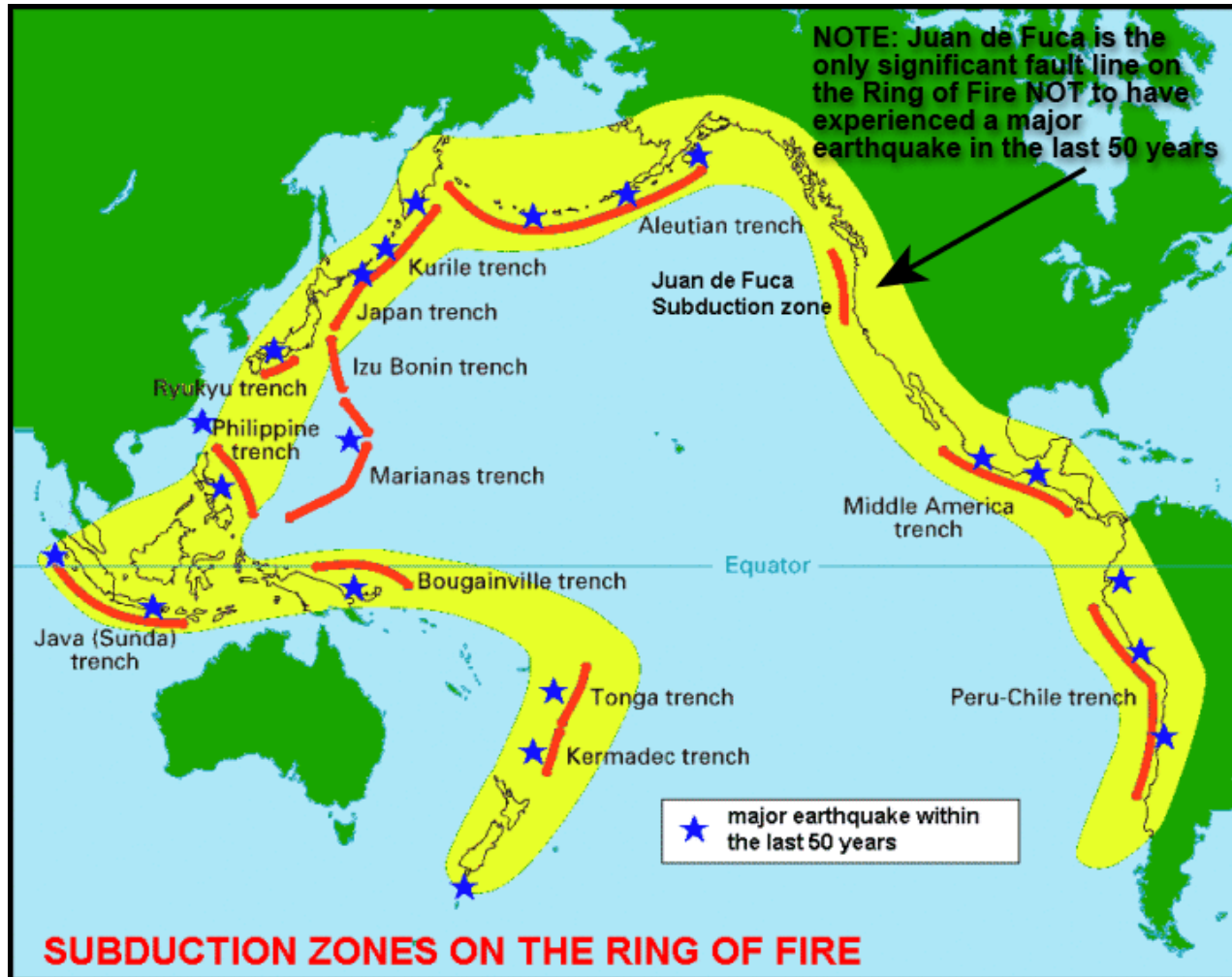




The CSZ Threat



Ring of Fire



The Ring of Fire accounts for 90% of all earthquakes, and 81% of the world's largest earthquakes

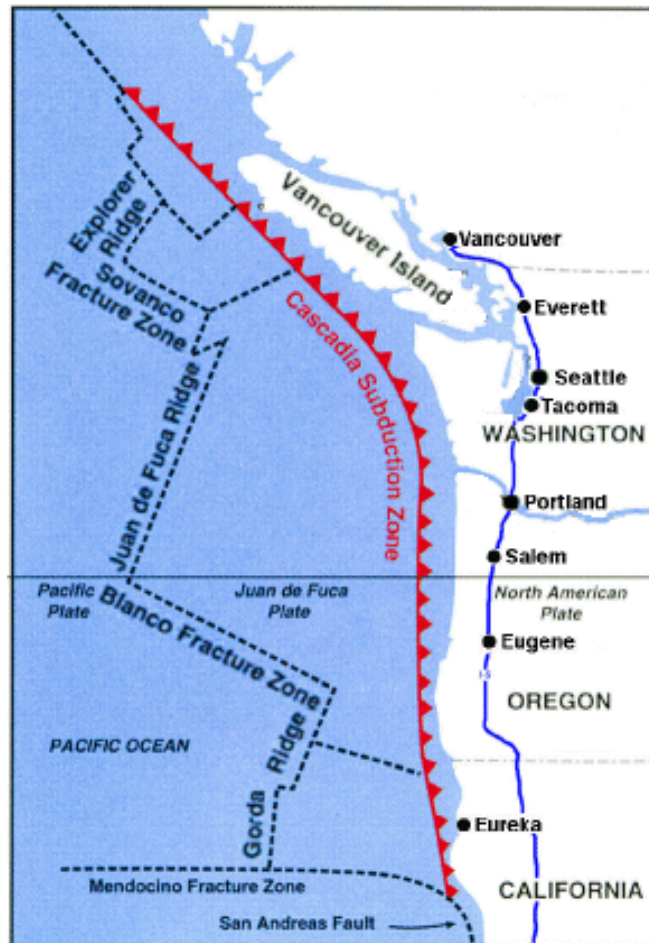
Subduction zones are shown in red

The CSZ fault line is part of the Ring of Fire

The CSZ is the only significant fault line on the Ring of Fire without a major quake in the last 50 years (see blue stars)



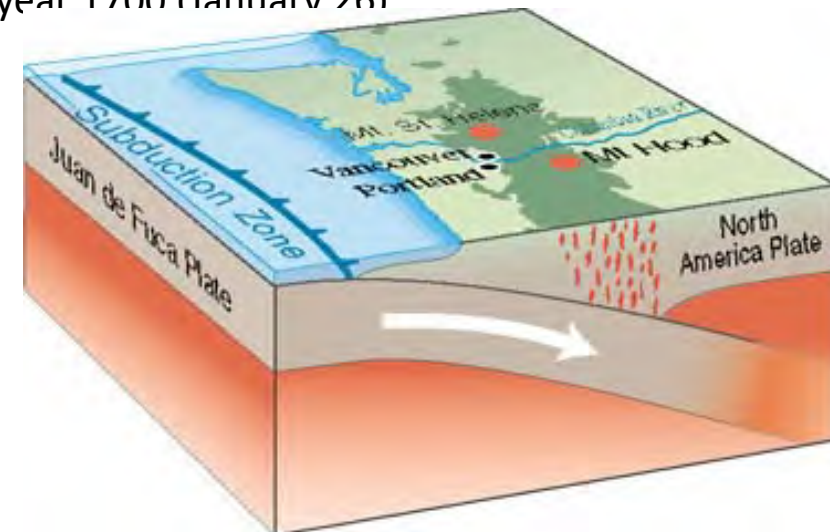
Cascadia Subduction Zone



The CSZ runs 800 miles from Southern British Columbia to Northern California, and lies 50 to 80 miles off the Pacific Coast

The heavy Juan de Fuca plate is sliding under the lighter North American plate

A magnitude 9.0 CSZ earthquake has occurred every 300 to 500 years (USGS – 400-600 years). The last CSZ earthquake occurred in the year 1700 (January 26)





An increase of 1 in magnitude results in ten times the shaking and 32 times more energy released by an earthquake.

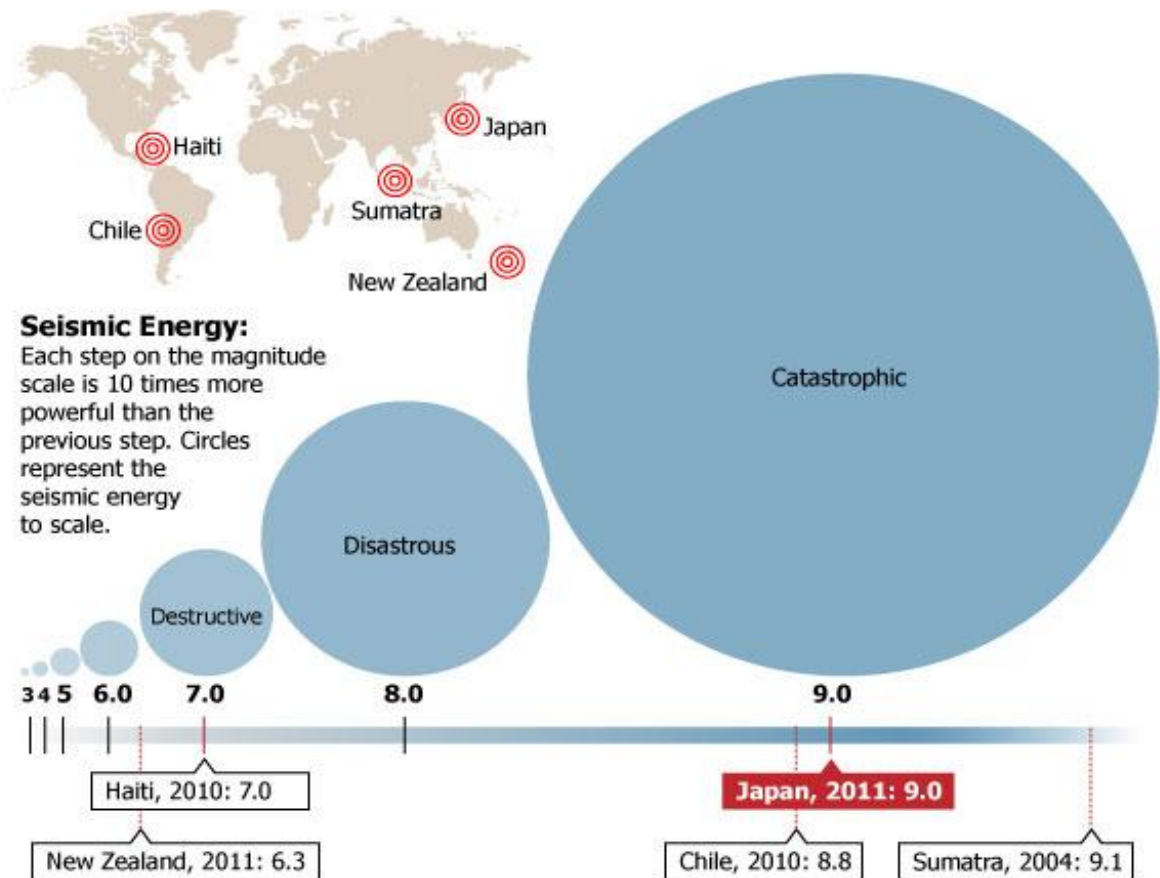
A Magnitude 9.0 Quake will be 100 times more powerful in terms of shaking and 1024 times more powerful in terms of energy release than the 2001 Magnitude 6.8 Nisqually earthquake.

Our probability of experiencing a M6.0 or greater quake within the next 50 years is more than 80%.

GET PREPARED NOW!!

Magnitudes of Recent Earthquakes

The earthquake off the east coast of Honshu, Japan's largest island, was the fifth-largest ever recorded, according to the U.S. Geological Survey (USGS), and the largest ever recorded in Japan. How it compares in magnitude with other major earthquakes:





Earthquake Aftershocks

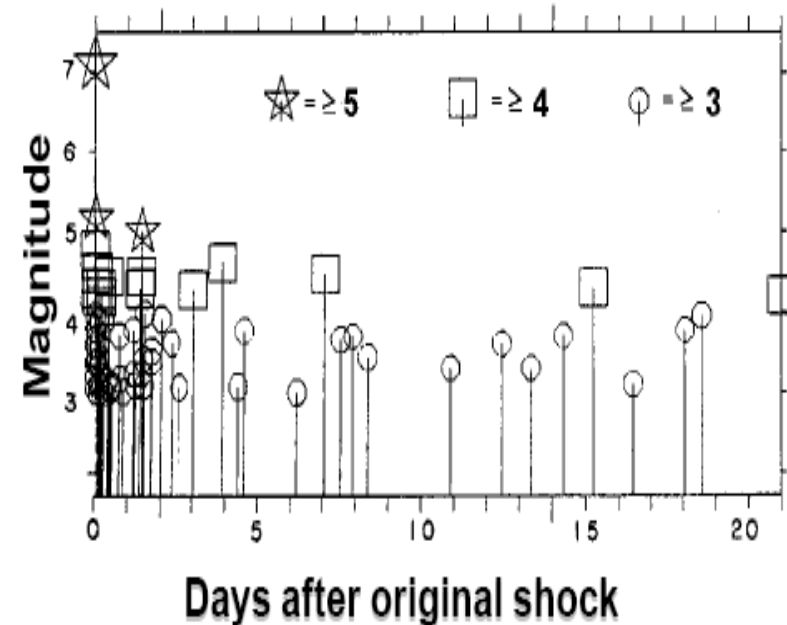
In the first week of a 9.0 Richter Scale Earthquake there will be one 8.0+ and ten 7.0+ Aftershocks

How Many Aftershocks ?

- USGS - Rule of Thumb
 - For every single decrease in magnitude, get 10 fold increase in number
- If original quake is M 7
 - 1 or so aftershock in range of M 6
 - 10 " " " " 5
 - 100 " " " " 4
 - 1000 " " " " 3

Source: USGS

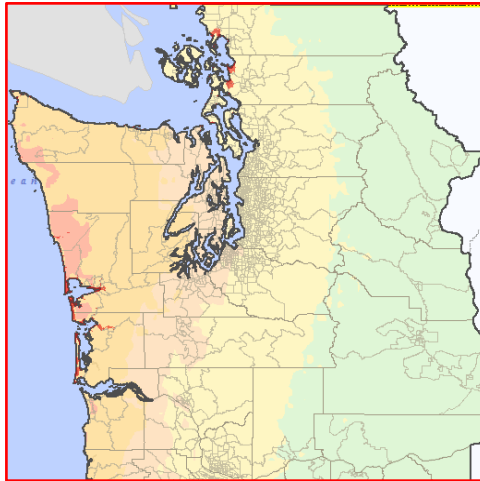
1989 Loma Prieta Aftershocks



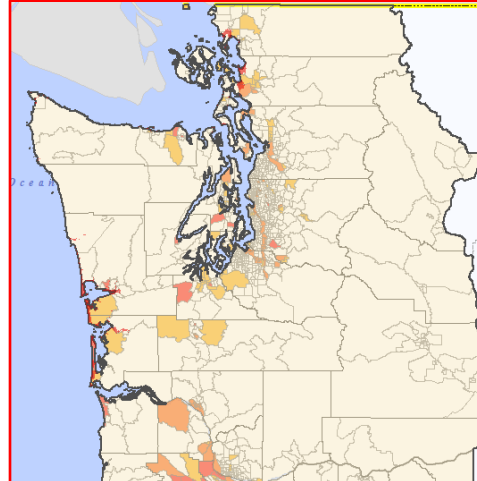


Ground Shaking Effects

Mercalli Index



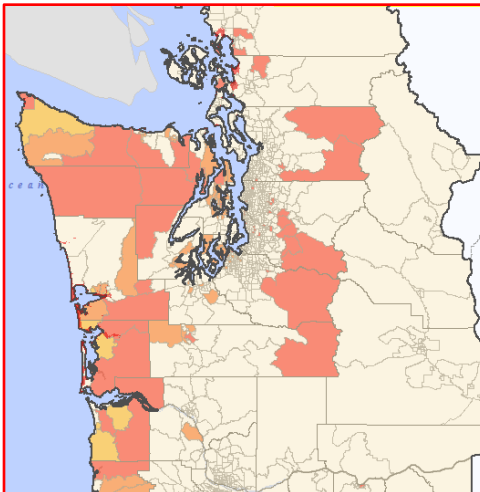
Liquefaction



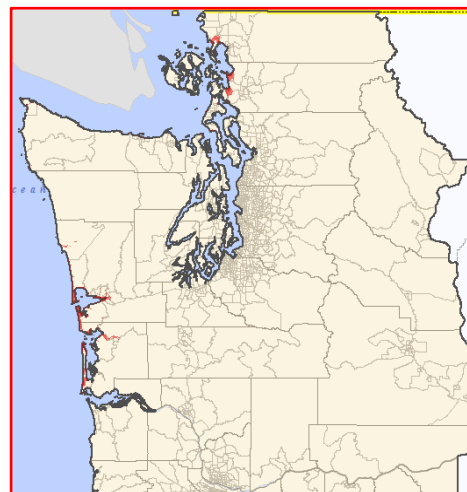
Mercalli Index: Ground shaking will depend on the actual fault rupture method and can not be accurately forecast. It is anticipated that the fault will rupture along its entire 700 mile length resulting in a magnitude 9.0 earthquake that will last 3-5 minutes. The intensity of the shaking will decrease with distance from the fault. Even so, Seattle is expected to experience a 7.0 magnitude or higher earthquake with 5 minutes of shaking.

Liquefaction: The cause of some of the most dramatic damage resulting from an earthquake, liquefaction areas can be accurately forecast based on soil types and water content. Some of the most susceptible areas are areas that have a high commercial potentiality, i.e. ports, bridges, commercial areas.

Landslides



Tsunami



Landslides: Landslides will occur up to hundreds of miles from the fault due to the intensity of the shaking. Landslide potential significantly increases with water content. If the CSZ rupture occurs during the rainy season, landslides will be most prolific.

Tsunami Inundation: Tsunami's are historically the biggest killer associated with earthquakes. The residents most affected are along Pacific Coastal areas. The numbers in jeopardy will increase sharply in summer months. Current estimates place as many as 50,000 residents in the hazard zone in February.



1st Order Effects - Shaking



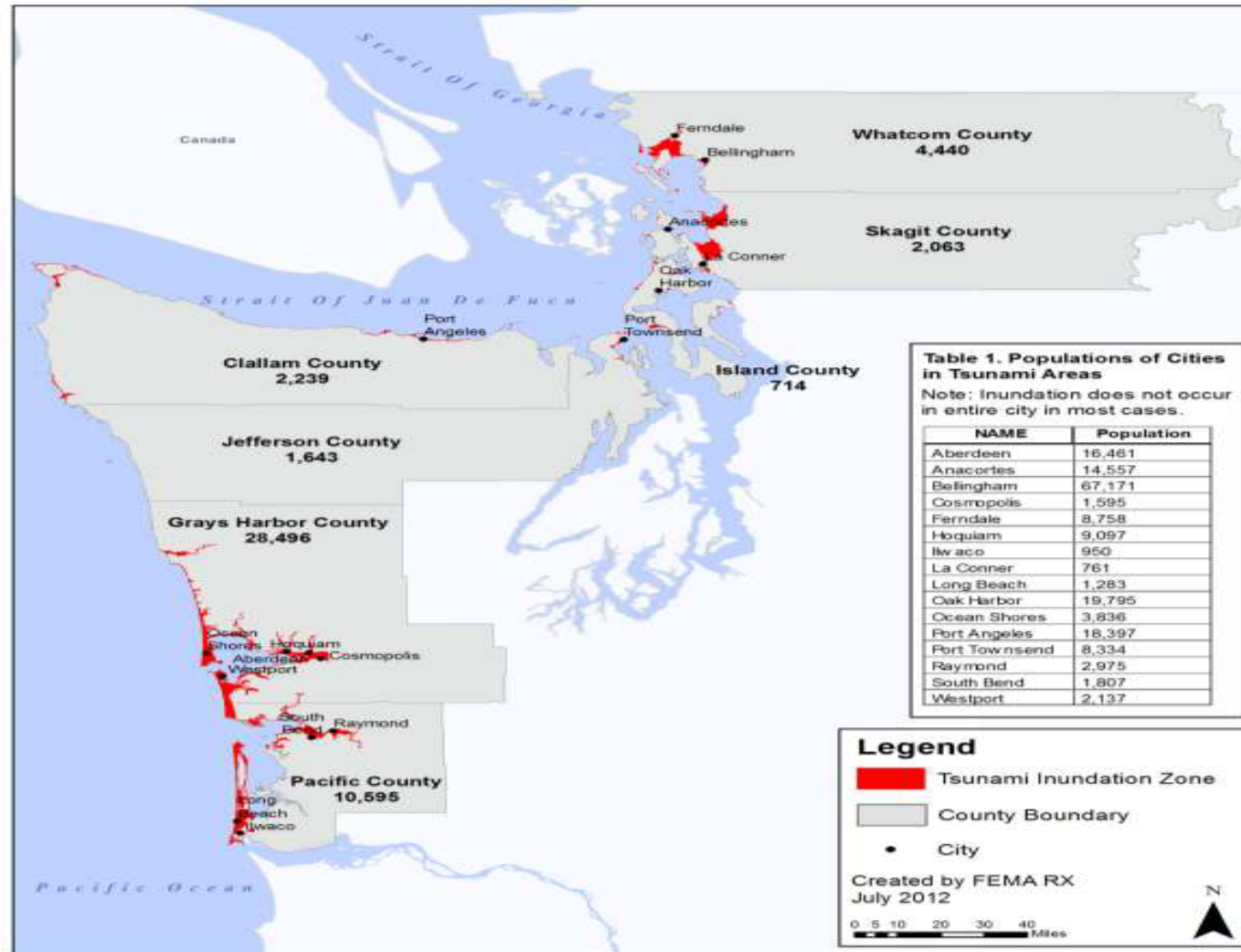


1st Order Effects - Liquefaction





Tsunami Inundation Areas



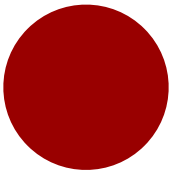


1st Order Effects - Tsunami

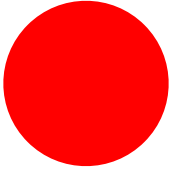




Legend



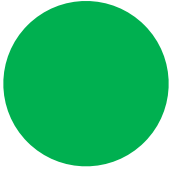
- Complete = Totally Destroyed.



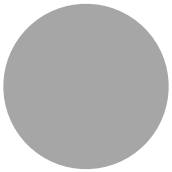
- Severe = Severely Damaged – Not Useable



- Moderate = Moderately Damaged – 50% Capacity



- Slight = Slightly Damaged – Useable

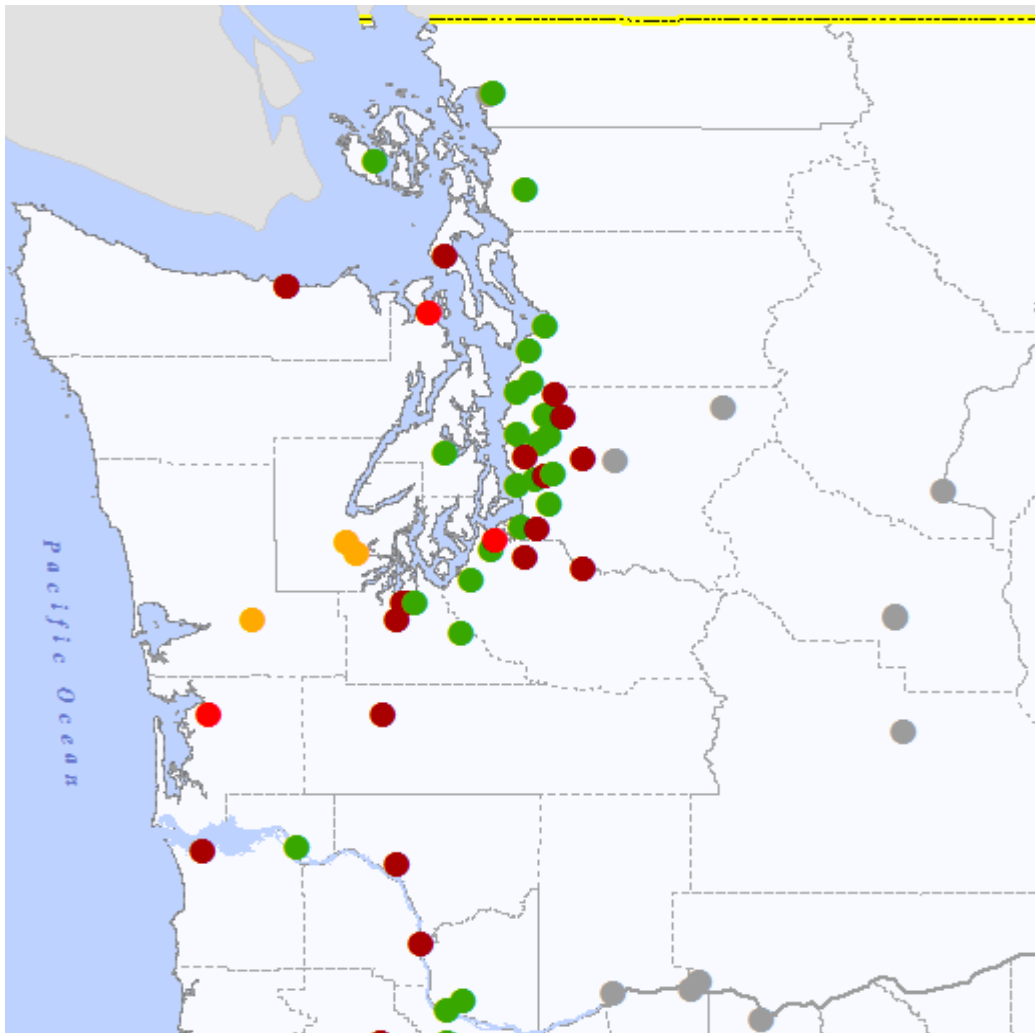


- None = Not Damaged

The HITRAC study is designed and intended to be **REPRESENTATIVE** not **PREDICTIVE**.



Emergency Ops Centers



These are general locations and forecast status of the known City, County and State EOCs.

There are 48 EOCs.

30% are completely destroyed, and 7% suffer severe damage and are unusable.

Result is 37% must devolve.

7% suffer moderate damage and may be partially usable, may devolve.

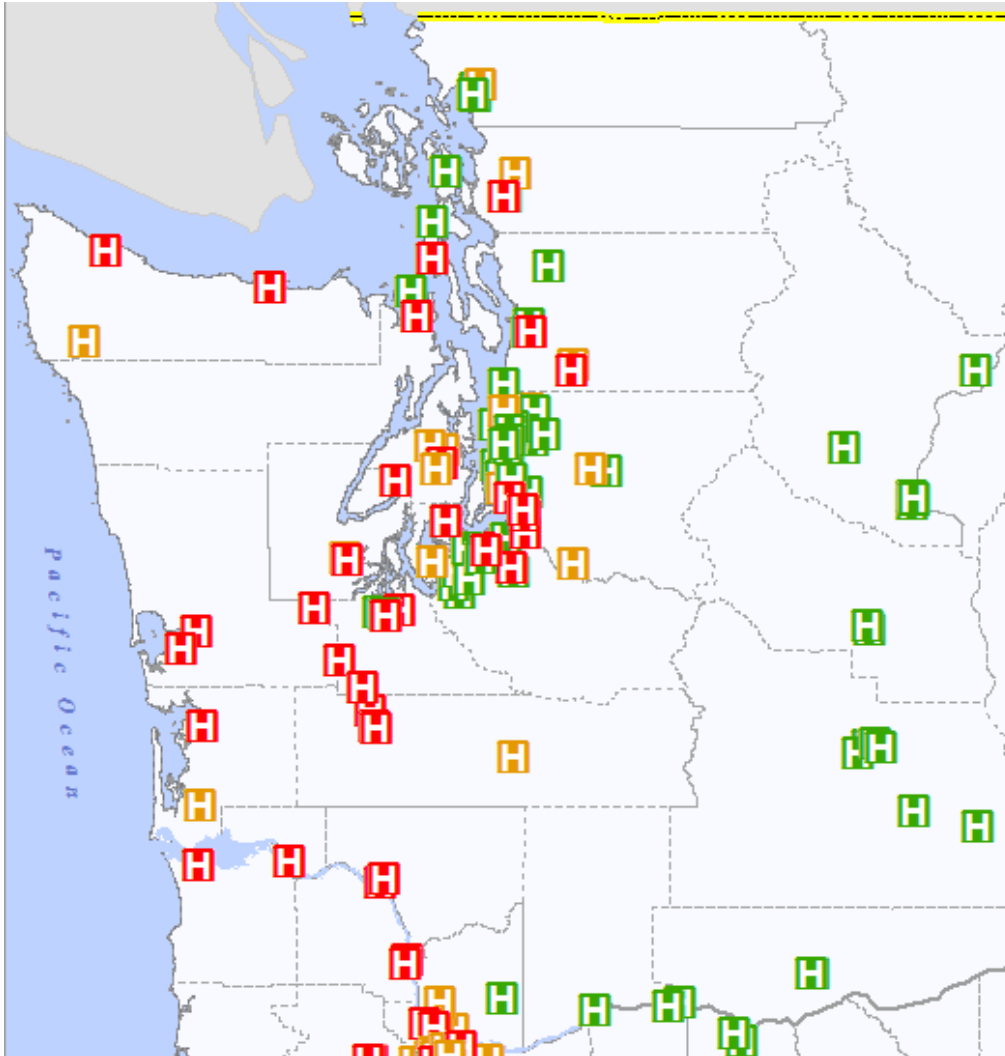
50% suffer slight damage, 6% suffer no damage.

56% are able to continue operations with minimal interruption.

State EOC sustains slight damage.



Hospitals



These are general locations and forecast status of the known Hospitals.

There are 112 Hospitals in the affected area.

36% suffer severe damage, are unusable, and will likely be completely offline.

17% suffer moderate damage and are only assumed capable of 50% normal capacity.

Total reduction is assumed to be 45% of total hospital capacity.

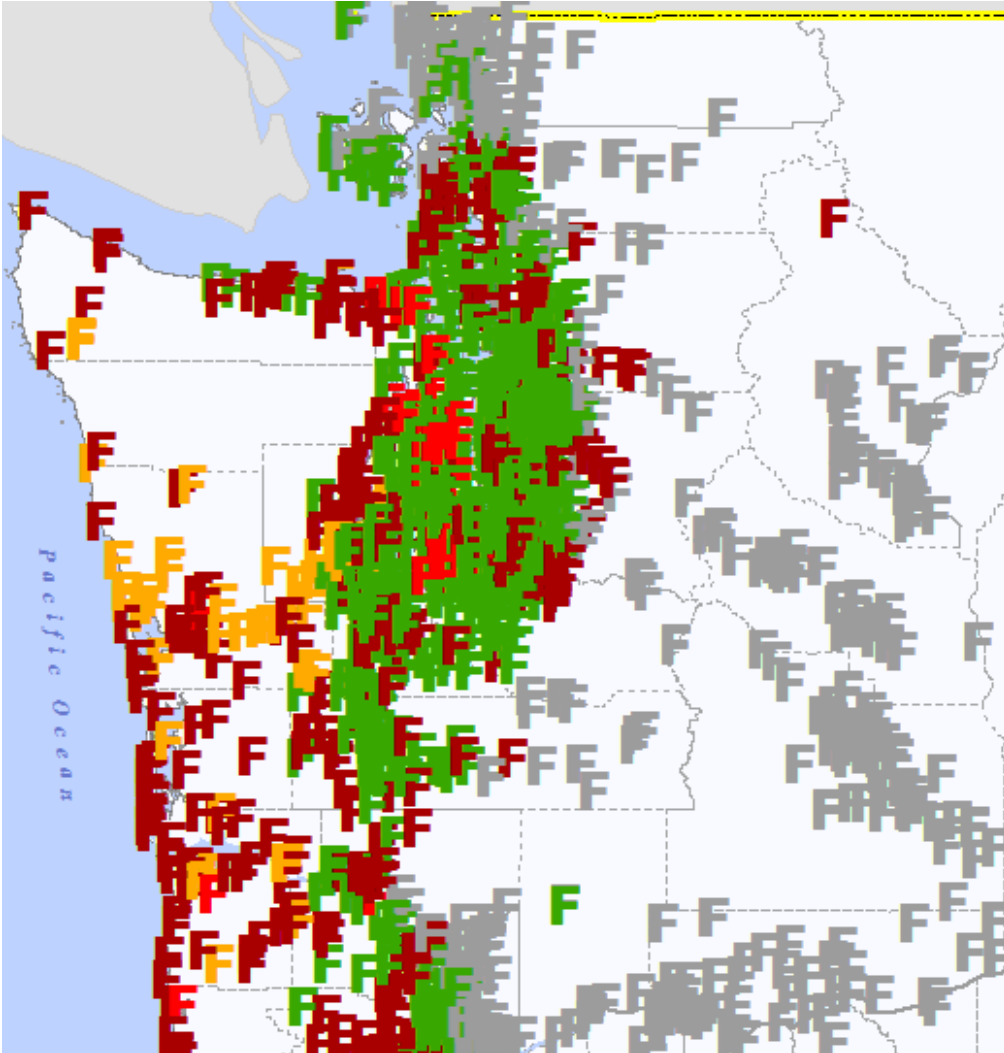
47% suffer slight damage and are able to continue to operate at capacity.

The facilities nearer to the epicenter suffer most significant damage resulting in **virtually no Hospital capacity west of the I5 corridor.**

These numbers discuss STRUCTURAL capacity, not patient capacity, which is further reduced due to lack of electricity, potable water, sanitation, etc.



Fire Stations



These are general locations and forecast status of the known Fire Stations.

There are 971 Fire Stations in the affected area.

30% suffer severe damage, are unusable, and are planned to be completely offline.

6% suffer moderate damage and are only assumed capable of 50% normal capacity.

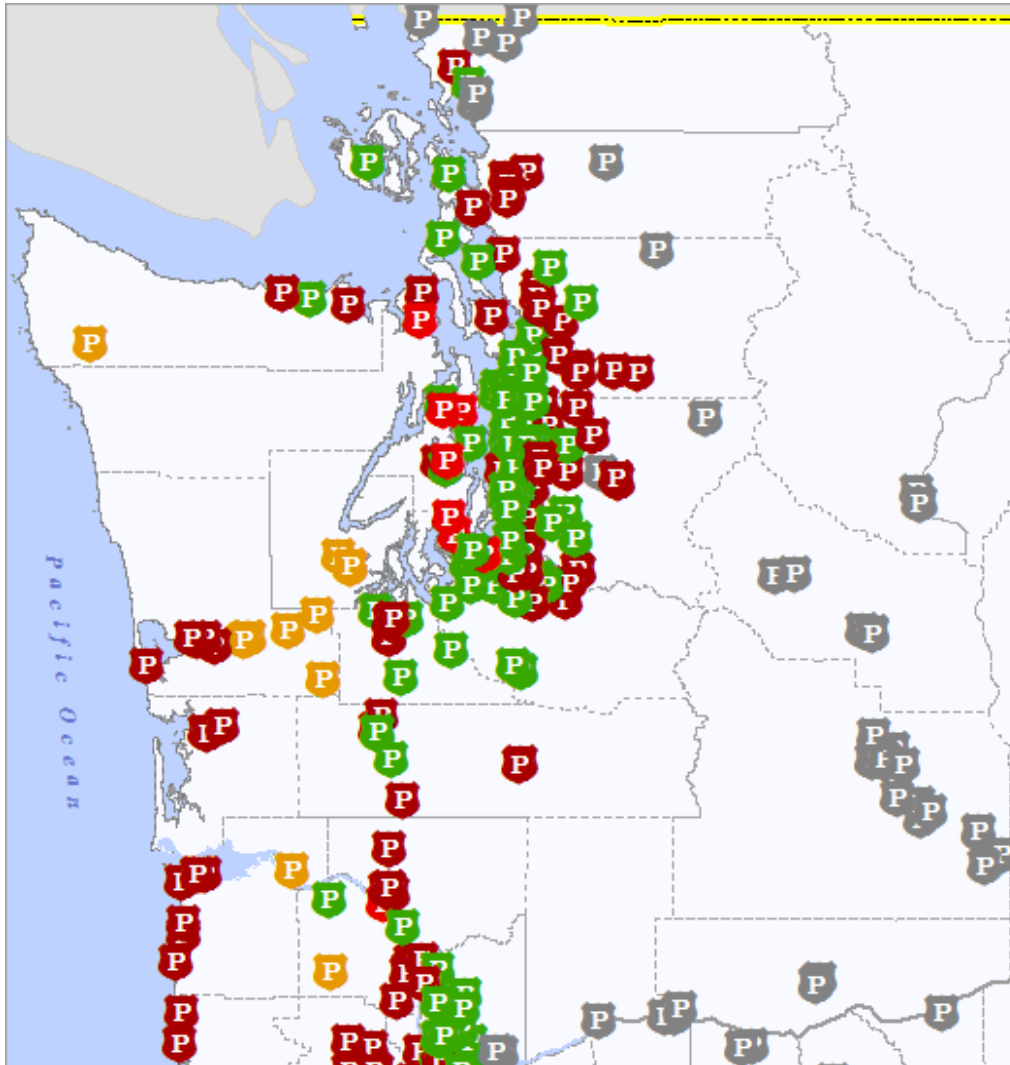
Total reduction is assumed to be 33% of Fire Response capability.

64% suffer slight or no damage and are able to continue to operate at capacity.

The facilities nearer to the epicenter suffer most significant damage resulting in **significantly reduced capability west of Shelton.**



Police Stations



These are general locations and forecast status of the known Police Stations.

There are 178 Police Stations in the affected area.

41% are completely destroyed, 7% suffer severe damage, are unusable, and are planned to be completely offline.

5% suffer moderate damage and are only assumed capable of 50% normal capacity.

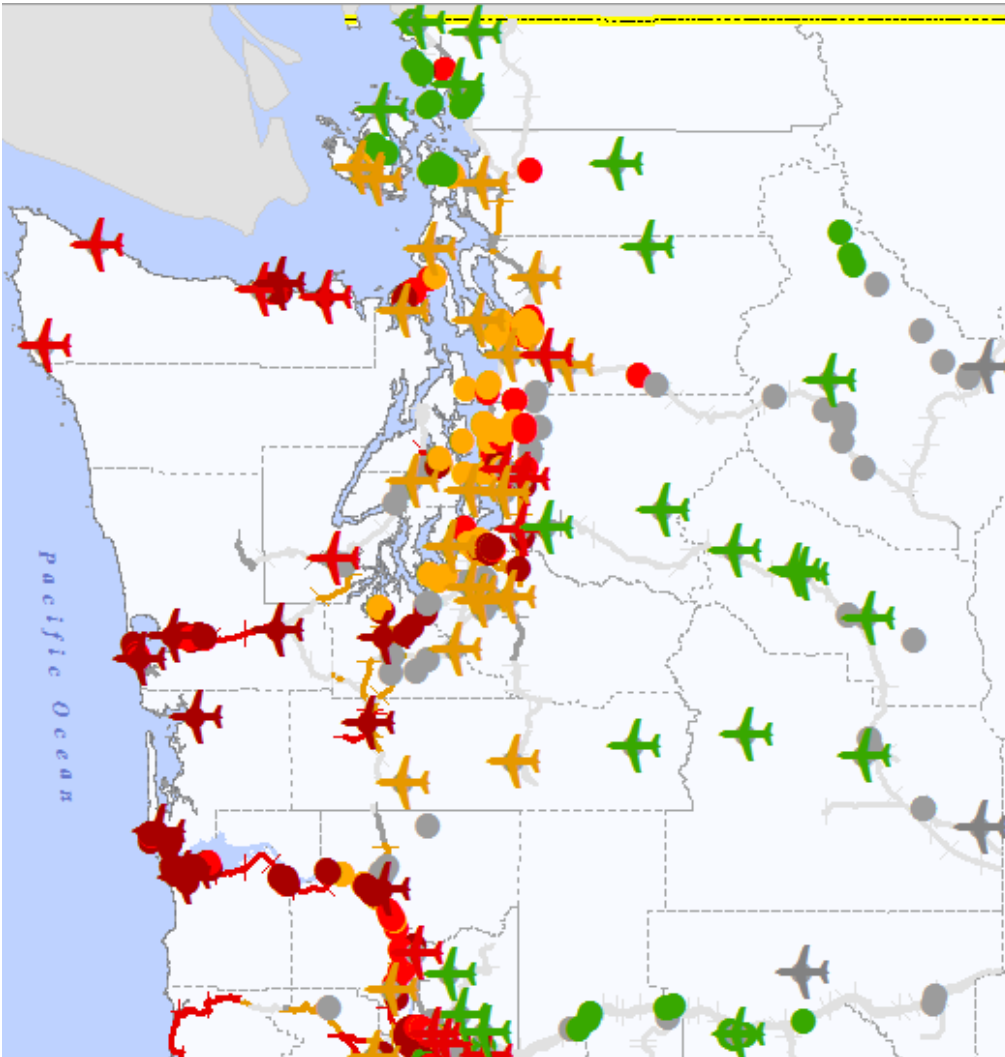
Total reduction is assumed to be 51% of Police Response capability.

48% suffer slight or no damage and are able to continue to operate at capacity.

The facilities nearer to the epicenter suffer most significant damage resulting in **significant degradation of Law Enforcement capability west of Shelton.**



Transportation - Sea, Air, Rail



Most facilities west of the I-5 corridor suffer complete to severe damage

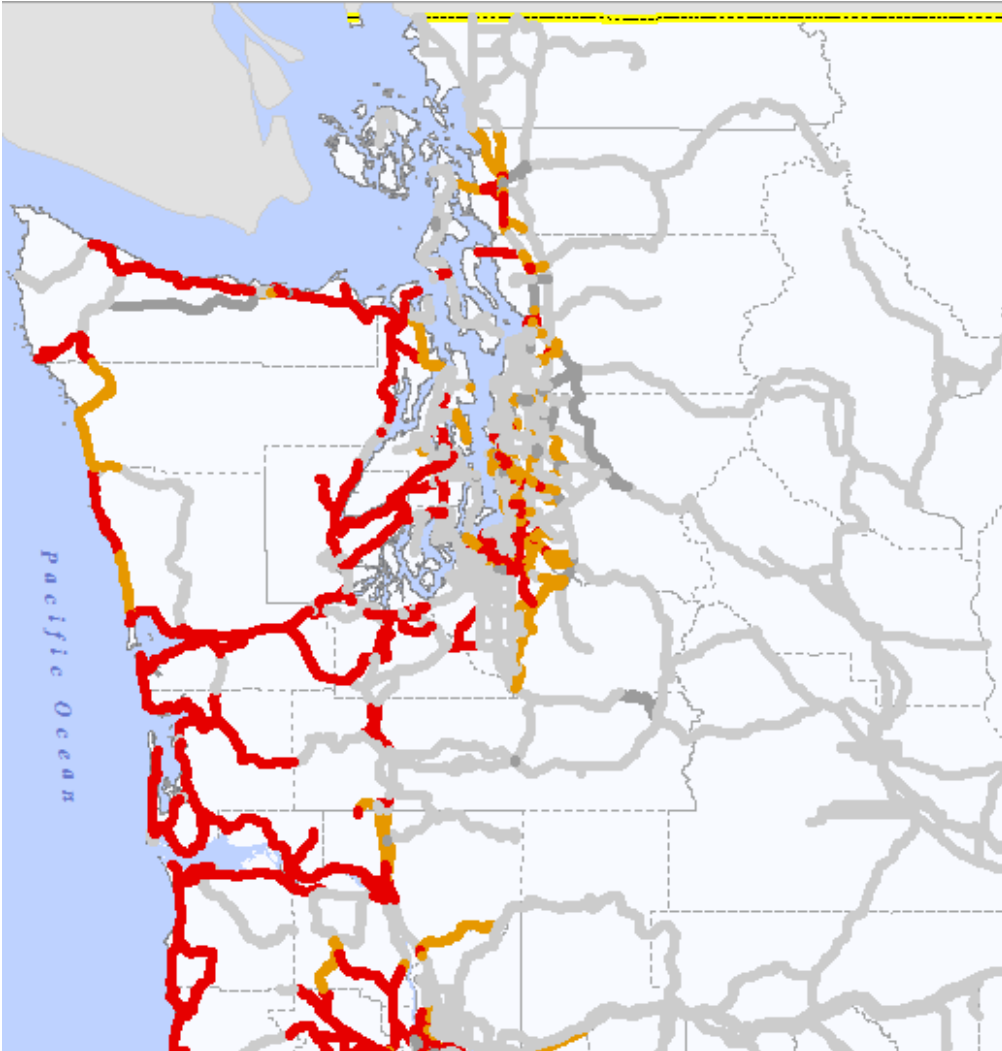
Most facilities along the I-5 corridor suffer severe to moderate damage

Most facilities east of the I-5 corridor suffer slight to no damage

Many of these facilities are located in liquefaction zones



Transportation- Highways



There is a vast network of County, State, and Federally maintained highways in the affected area. Ground transportation is the primary method of movement for most commodities.

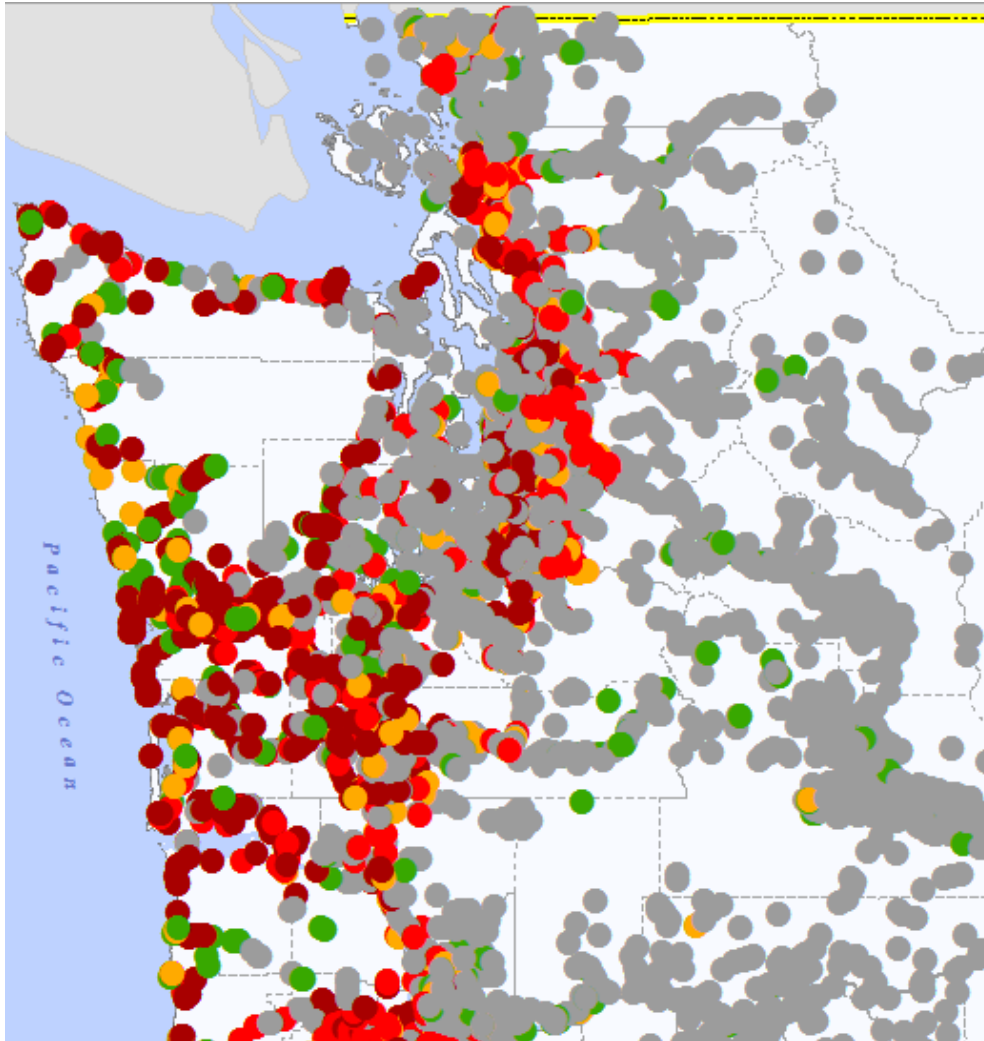
The highway system will suffer the most damage in the vicinity of the coast with both earthquake and tsunami damage. This will significantly impact any lifesaving or recovery operations, and will drive route clearance and roadway repair to a very high priority across the region.

In the I-5 corridor roads in areas of high liquefaction susceptibility are likely to prove impassable.

In the initial stages of the CSZ response the only method of reaching coastal communities will be by air. There are no surviving ground routes to the coastal region.



Transportation- Hwy Bridges



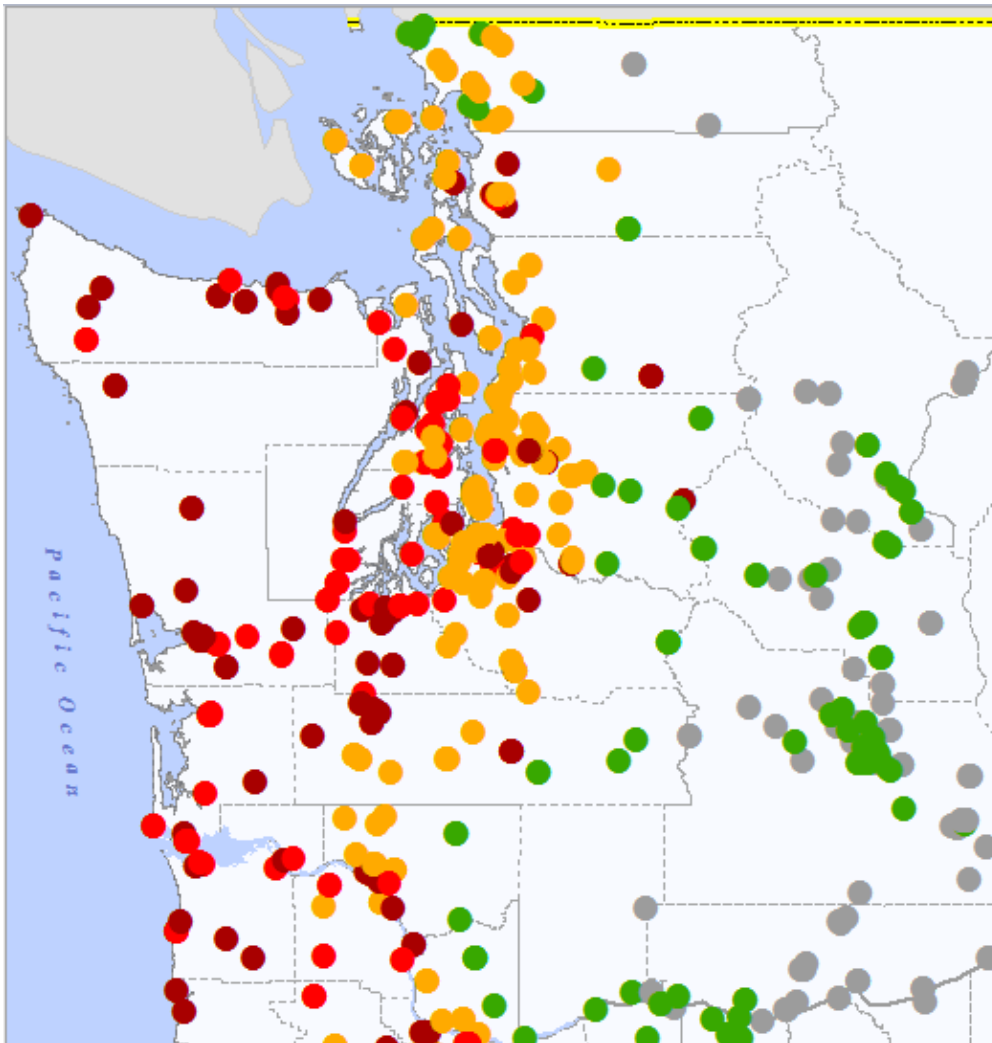
Virtually every highway crosses numerous bridges. Route identification that does not cross a bridge will not be possible when attempting to reach any isolated community. Bridges in the affected are predominantly old and were built prior to establishment of significant seismic building requirements.

The assessment of bridges as early in the IAA process as possible will be key to the development of routes into isolated communities. Identifying bridges that need the least repairs will speed up recovery operations.

The lack of suitable bridges will be a factor in the determination of the recovery efforts and timelines.



Communication Facilities



This slide represents the number of communications facilities in the affected area as of the time of the creation of the FEMA analysis.

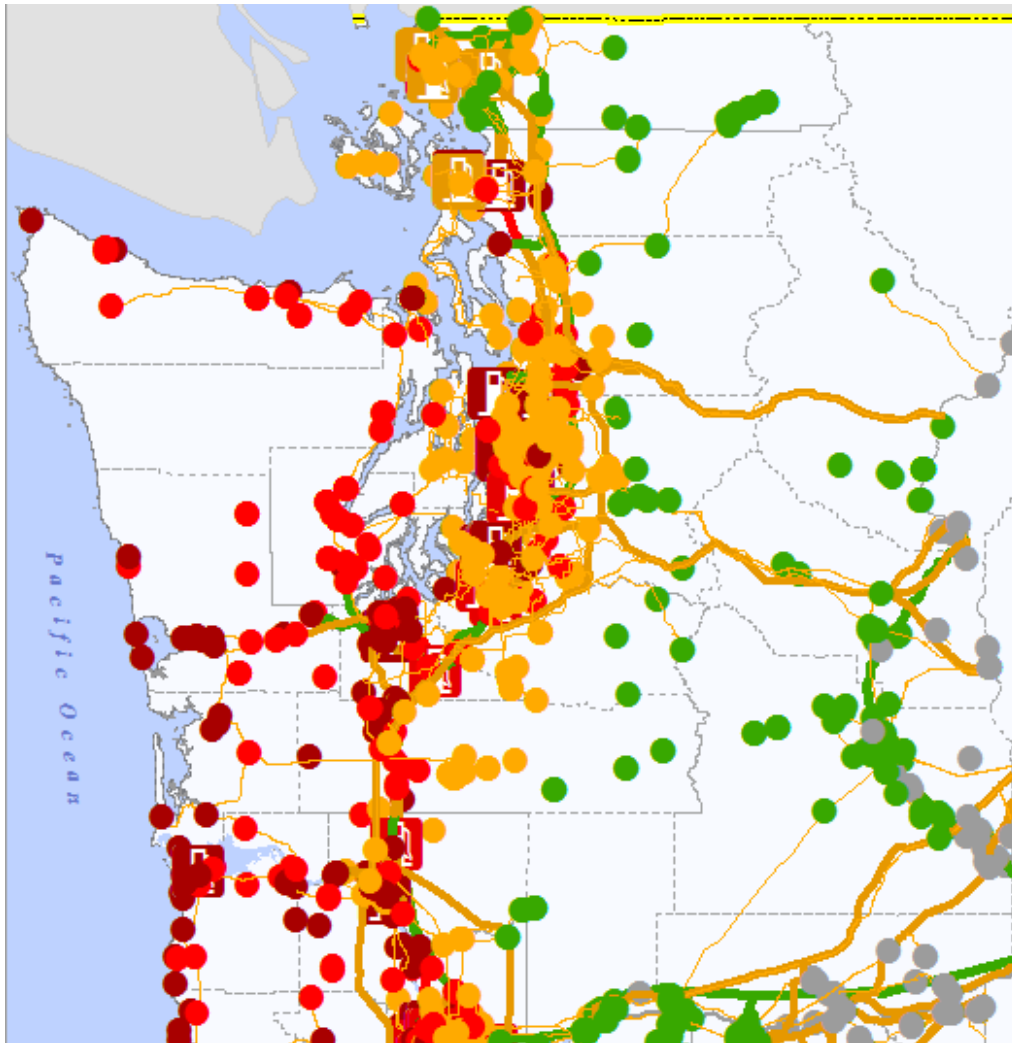
There are approximately 53 AM Broadcast Stations, 42 FM Broadcast Stations, 15 TV Broadcast Stations, 1 Internet Exchange Point, and 171 Cellular Towers.

In general terms the communications infrastructure suffers damage commensurate with the significance of the MMI index. Although the communication infrastructure is ultimately dependant upon electrical power and may be unavailable after the CSZ for an extended period in the entire region, and for even longer periods in the areas of greatest damage, due to the inability to repair and sustain these facilities.

These factors will greatly affect mass communications ability. Additionally, this slide shows cell towers, but does not account for the cellular control facilities and/or switchboards. Those facilities are presumably much more difficult to repair or replace than a cellular tower.



Utilities



- This slide provides an overview of the utilities networks across the affected area. In general the amount of damage decreases from West to East. Major networks will be out-of-service until significant repairs can be made.

- There are approximately 440 major electrical facilities and a vast network of electrical power lines, both above and underground throughout the region.

- There are 68 major Natural Gas facilities and 12 counties contain 22 major sections of NG pipe network.

- There are 54 petroleum processing facilities, and 9 counties contain 16 major sections of petroleum pipeline.

- There are 35 known Potable Water Facilities.

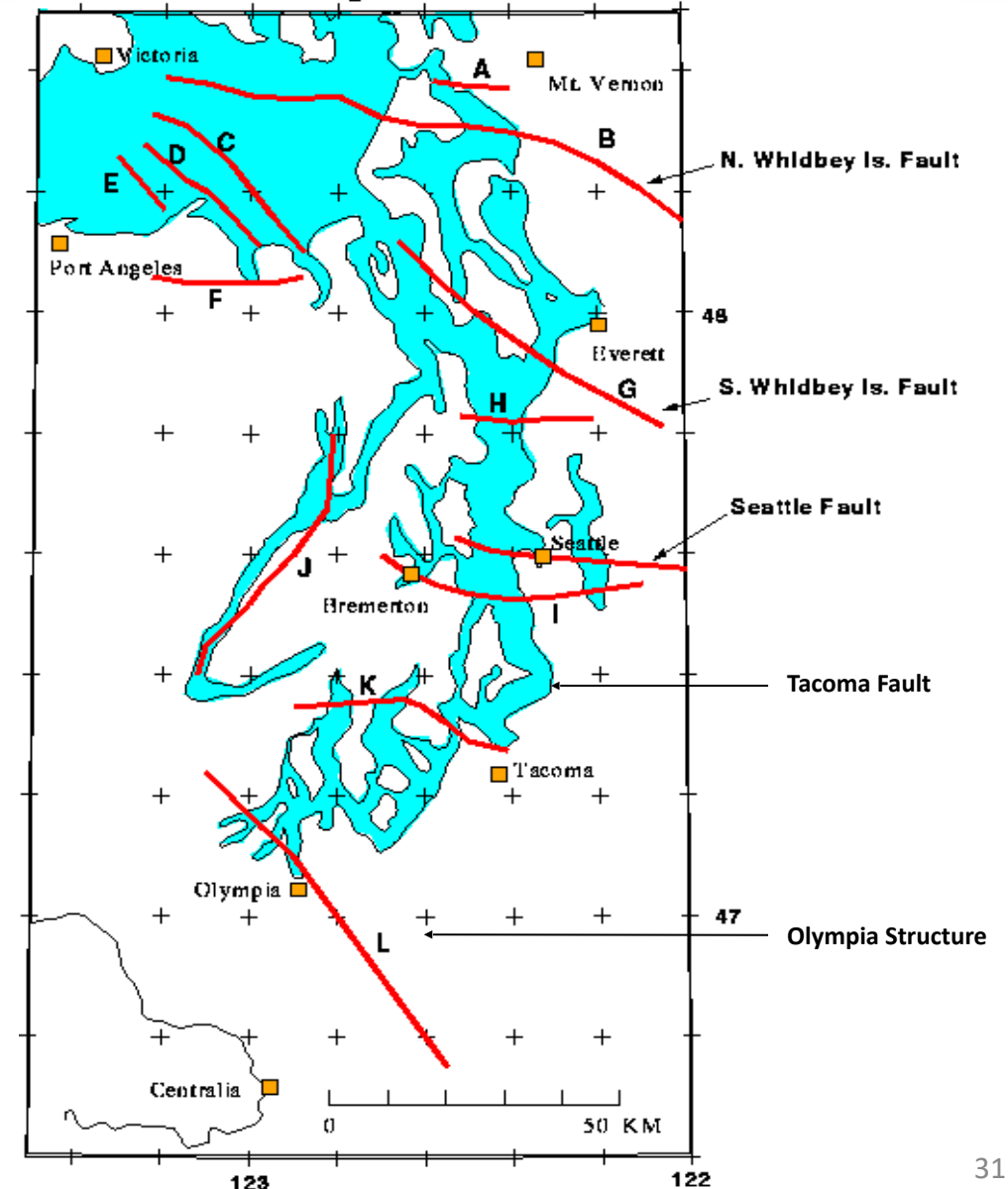


Planning Factors (FEMA)

	Washington Total	Notes
Land Area (Sq. Miles)	71,303	
Miles of Pacific Coastline	157	Does not include Strait of Juan de Fuca or shores of Puget Sound.
Population	6,894,121	
Population exposed to tsunami	50,190	
Residential buildings damaged (Slight to complete damage)	507,701	
Short term human sheltering requirements	410,127	
Short term pet sheltering requirements	254,357	
Mass feeding and hydration requirements (People)	1,274,327	
Mass feeding and hydration requirements (Pets)	777,340	
Deaths	8,440	Projection accounts for initial earthquake and tsunami, does not account for exposure, disease, dehydration, starvation, or follow on tsunami's and aftershocks.
Injuries	12,114	
Hospital patient evacuation requirements	15,501	Evacuation requirements based on projected numbers of facilities determined to be unusable. Does not account for evacuation to create room for newly injured.
Nursing home patient evacuation requirements	65,249	
Building debris (Cubic Yards)	13,174,243	



Major Fault Zones in the Puget Sound





Cascadia Rising 16



Cascadia Rising 16

- Joint Federal, State, Local Exercise conducted 7 to 10 June, 2016
- National Linkage
- Focus Areas:
 - Operational Coordination
 - **Operational Communication**
 - Situational Awareness
 - Mass Care
 - Public Health and Medical Services
 - Critical Transportation



Cascadia Rising 16 Strategic Observations

- Time is of the essence
 - Massive National/International response required
 - Needs and immediacy are overwhelming
- Detailed Planning is imperative
- Transportation infrastructure is the lynchpin of successful response
- **Effective, survivable communication is essential**
- Public preparedness is crucial
- CSZ is a National Issue

Hurricane Maria has validated the importance of these

We are not prepared to operate in a degraded communications environment over an extended period.

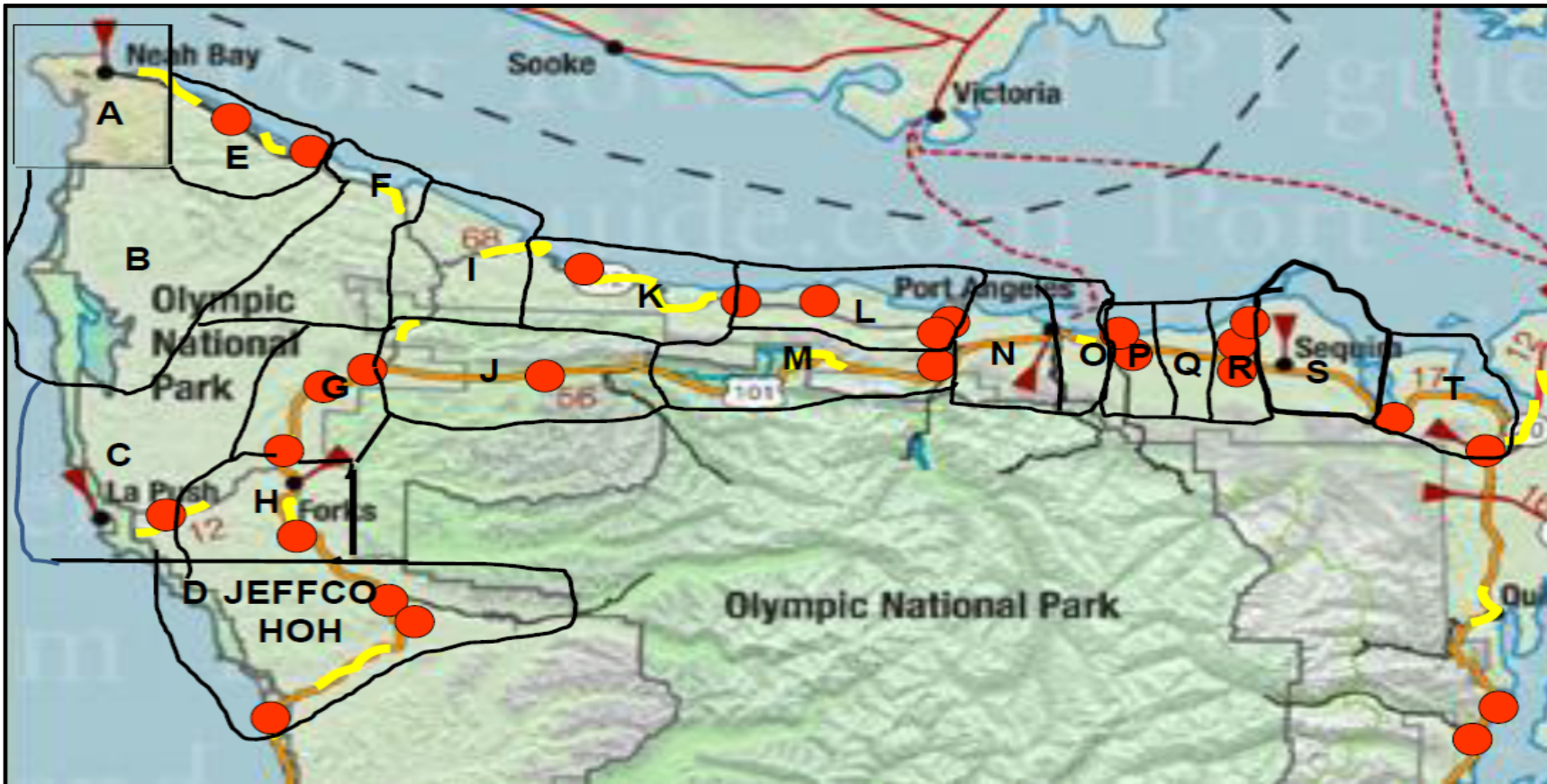


Our Focus Going Forward

- Response Planning
 - ESF-6 Mass Care and Sheltering
 - ESF-8 Public Health and Medical
 - ESF-1 Transportation
 - **ESF-2 Communications**
 - ESF-12 Energy
- Mitigation Planning
 - Focused on building resiliency in our critical infrastructure, in particular our lifeline sectors - transportation, communications, energy
 - **Family and personal preparedness/resiliency**
- Recovery Planning
 - Washington Restoration Framework



Clallam County – Micro Islands



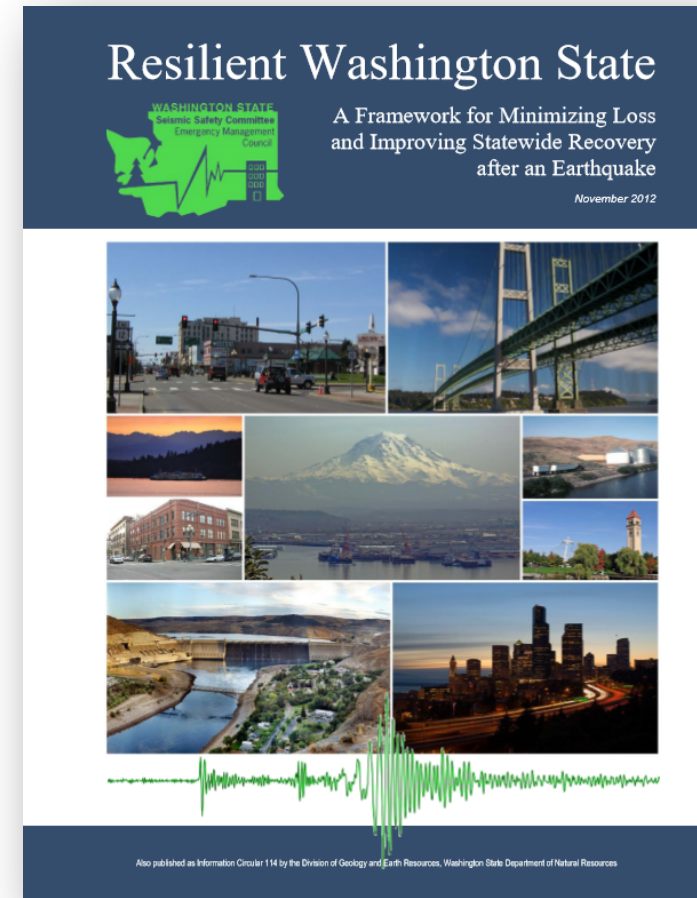
Damaged roads and bridges divide the county into at least 20 micro-islands.



Resilient Washington State

“A resilient state is one that maintains services and livelihoods after an earthquake. In the event that services and livelihoods are disrupted, recovery occurs rapidly, with minimal social disruption, and results in a new and better condition.”

November 2012





Resilient Washington State

TARGET STATES OF RECOVERY: WASHINGTON'S UTILITIES SECTOR									
	Event occurs	0-24 hours	1-3 days	3-7 days	1 week-1 month	1-3 months	3 months-1 year	1-3 years	3+ years
Domestic water supply									
Supply & transmission pipes				NL			L		
Distribution pipes					NL		L		
Wastewater systems									
Treatment facilities						NL	L		
Sewer pipes						NL		L	
Flood control									
Dams						X			
Levees								X	
Electricity									
Transmission								X	
Distribution, 60% restored					X				
Distribution, 70% restored						X			
Distribution, >70% restored							X		
Natural Gas									
Transmission			NL		L				
Distribution, 40% restored					X				
Distribution, 90% restored						X			
Petroleum									
Refineries & transmission								X	
Distribution						X			
Information and communication technology						X			



Resilient Washington Subcabinet

The Resilient Washington Subcabinet was convened in January of 2017 to help our state better prepare for natural disasters, including earthquakes, tsunamis, wildfires, drought, storms and flooding.

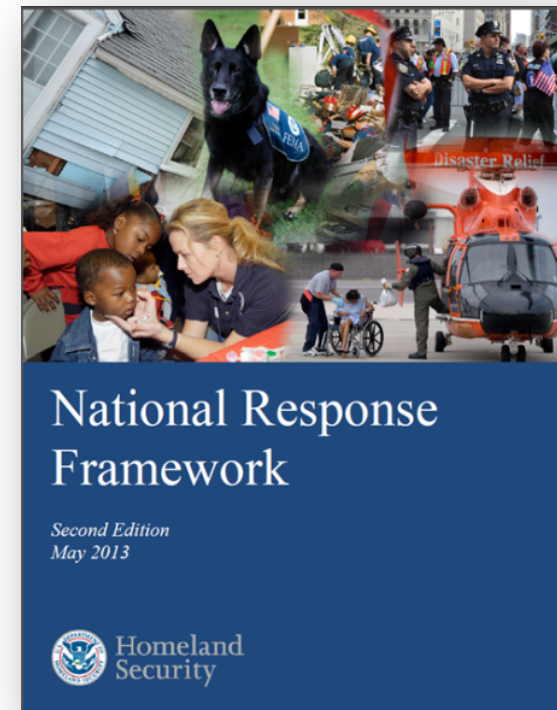
Recommendation 2 of 10:

Encourage utility providers to identify vulnerabilities in their system and mitigate deficiencies.



Emergency Support Function 2 - Communications

- Coordination with telecommunications and information technology industries
- Restoration and repair of telecommunications infrastructure
- Protection, restoration, and sustainment of national cyber and information technology resources
- Oversight of communications within the state incident management and response structures





WASHINGTON MILITARY DEPARTMENT

Emergency Support Function 2 - Partners





Washington Emergency Communications Coordination Workgroup (WECCWG)

- Purpose:
To forge and strengthen our public, private, and tribal partnerships to enhance emergency communications statewide.
- Vision:
A community of professionals working together to provide reliable and resilient emergency communications throughout Washington state in times of crisis.





Upcoming WECCWG Meetings

- Date: May 10
Location: Federal Way
Theme: Catastrophic Planning
- Date: September 27
Location: TBD in Central Washington
Theme: Public Warning
- Information: <http://mil.wa.gov/WECCWG>





Amateur Radio Emergency Services Strengths

- Number of licensed amateur radio operators
- Resilience of technologies
- Technical expertise
- Mode and band agility
- Mobility
- Cheaper equipment
- Evolving technologies





Amateur Radio Emergency Services Opportunities

- Development, synchronization, and maintenance of local, regional, and state communication plans
- Integration of amateur radio in EOC organization, infrastructure, and procedures
- Increased standardization of processes and procedures
- Inventory/directory of resources/infrastructure
- Increased involvement of amateur radio in emergency management exercises





Emergency Public Information System (EPIS)

- Effort initiated by the State Emergency Communications Committee (SECC) in 2015
- Collaboration between emergency management and media broadcasters to continue the delivery of coordinated, reliable information to the whole community following a catastrophic incident which likely will have damaged large portions of the broadcast infrastructure.





Wireless Emergency Alerts (WEA)

- Delivery to 100% of the target area with no more than a one-tenth of a mile overshoot
- Require the WEA alerts be preserved for at least 24 hours after the alert is received
- Message length extended to 360 characters and include support for Spanish-language messages





Missile Alert



- On January 13, Hawaii Emergency Management issued a false alert for an incoming ballistic missile.
- The warning was cancelled 34 minutes later.
- FCC determined:
 - Combination of human error and inadequate safeguards
 - Lack of preparation for how to cancel false alert



Washington State EOC Alert & Warning Center

EMD/FEMA Region X joint review of attack warning procedures

- Public alert origination at federal level
- Safeguards commensurate with warning significance/consequences





Questions?